



Coronagraph Design and Metrics

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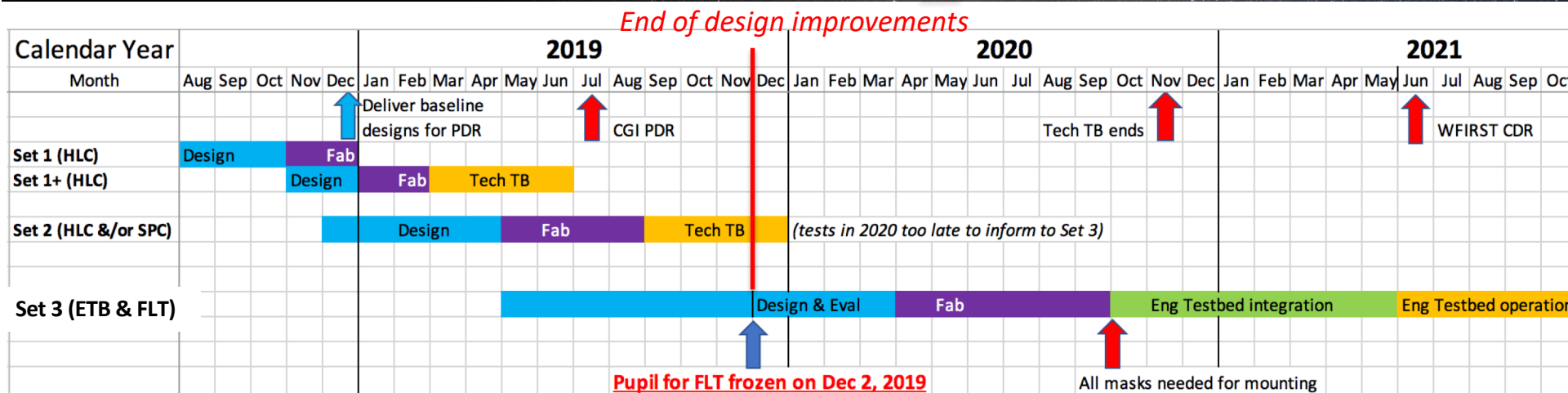
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Outline

1. Timeline
2. Baseline Designs
3. Priorities
4. Merit Functions

Timeline



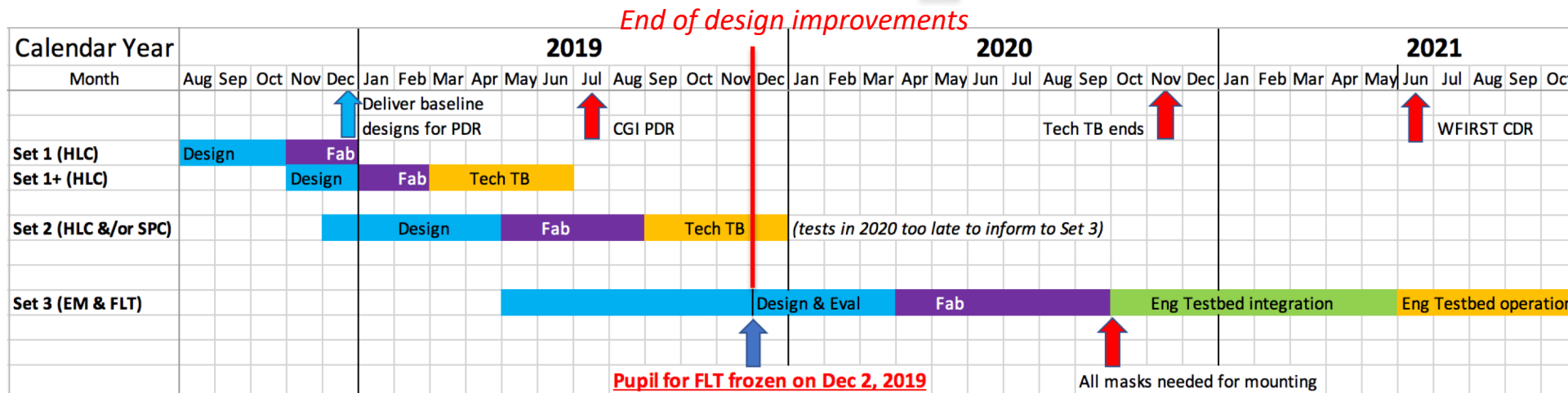
3 Mask Design Cycles Remaining

1. Test new fab method of HLC masks
2. Test new mask features or combos
3. Final Masks: for ETB and FLT

*Last chance for big changes
requiring HCIT verification*

- **12 months left total** for all improvements to CGI coronagraph design process
 - Engineering Testbed (ETB) required to have same exact mask designs as FLT.
 - ETB masks needed for mounting & testing months before ETB is built.
- **5 months left to get new mask features or combos** (for Set 2)
 - Time includes designing *and modeling*.
 - After 6 months, wouldn't get testbed results in time to inform ETB+FLT designs
- **Remainder for improving design SW and algorithms** (before Set 3)

Baseline Designs



- Phase B designs to be baselined **this month**
- Phase B baseline will have same three modes as before
 1. HLC for Narrow FOV
 2. SPC for IFS
 3. SPC for Wide FOV
 - Not enough data to support switching to HLC for IFS at this time.

Priorities

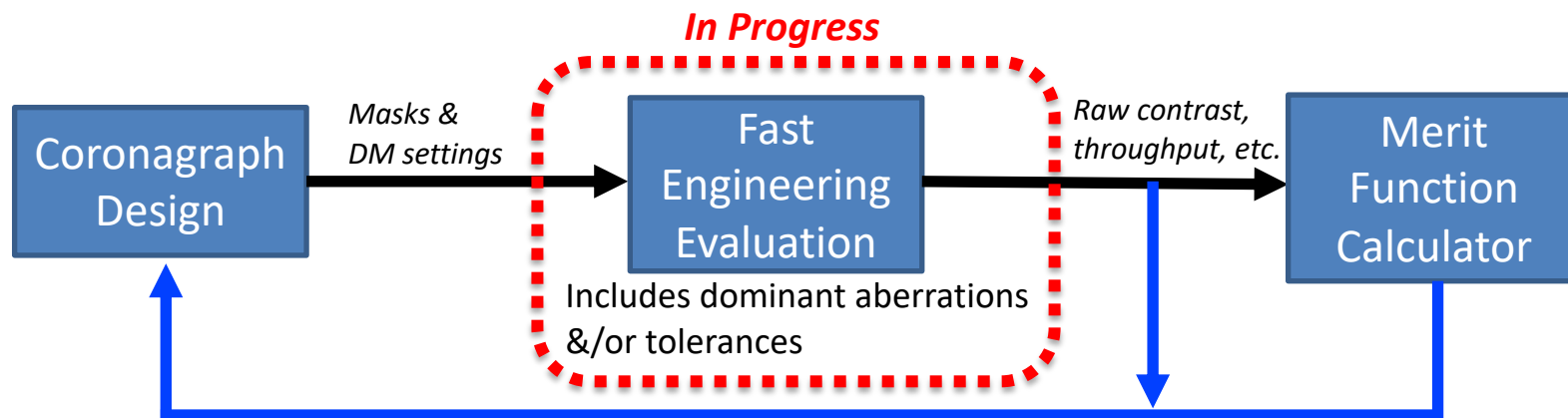
Available Coronagraph Elements:

- 2 Deformable Mirrors (DMs)
- Shaped pupil (SP)
- Focal plane mask (FPM)
- Lyot stop (LS)

Top Priorities:

1. Make wavefront control easier for HLC
 - How? More complicated FPM for less DM effort
2. Improve spectrograph performance
 - **higher throughput** and/or **360° FOV**
 - Possible directions?
 - **Switch to HLC** (increase to $\geq 15\%$ bandwidth)
 - **Hybrid SPC**
3. Develop **merit functions** and evaluation procedures.
 - Needed to declare new designs better/worse and viable/unviable.

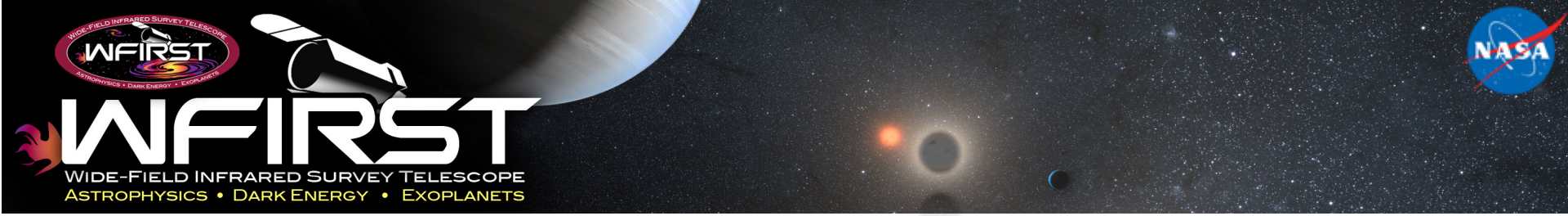
- Most remaining performance gains will be from trading something for something else.
- Designers need a **fast merit function calculator** to see if we made performance better/worse/same. Requires:
 1. Evaluation evaluation
 2. Merit function



- Engineering evaluation:
 - Procedure to be finalized this Thursday.
- Merit functions by mode:
 1. **Narrow FOV Imager:** Flux ratio noise (FRN). Calculator coming from SE.
 2. **IFS:** Flux ratio noise (FRN). Calculator coming from SE.
 3. **Wide FOV Imager:** TBD combo of throughput, contrast, and encircled energy

Summary

- In last 12 months of coronagraph design
- No major changes to 3 baselined modes for PDR/Phase B
- Better designs still being investigated. One more design+fab+testing round next summer.
- For design comparisons, evaluation code and merit function calculators being developed.
 - **Action item for SITs:** merit function needed for disk imaging



Extra Slides

Team Members

Team Member	Institution	Roles in FY19
A.J. Riggs	JPL	Schedule, budget, hybrid design R&D, software development, SPC design
Dwight Moody	JPL	HLC R&D
Jessica Gersh-Range	Princeton	SPC trade studies, hybrid design R&D
Jorge Llop-Sayson	Caltech	HLC trade studies, hybrid design R&D
Erkin Sidick	JPL	Design algorithms, LOWFS modeling
Navtej Saini	JPL	Software development

Main tasks this fiscal year:

1. Hybrid design R&D
2. Software development
 - Adding features, speedups, & cluster compatibility